

BULLETIN NO. 43

DEPARTMENT OF AGRICULTURE
SASKATCHEWAN

VARIATIONS IN CREAM TESTS

DIFFERENCE BETWEEN BUTTER AND BUTTER FAT

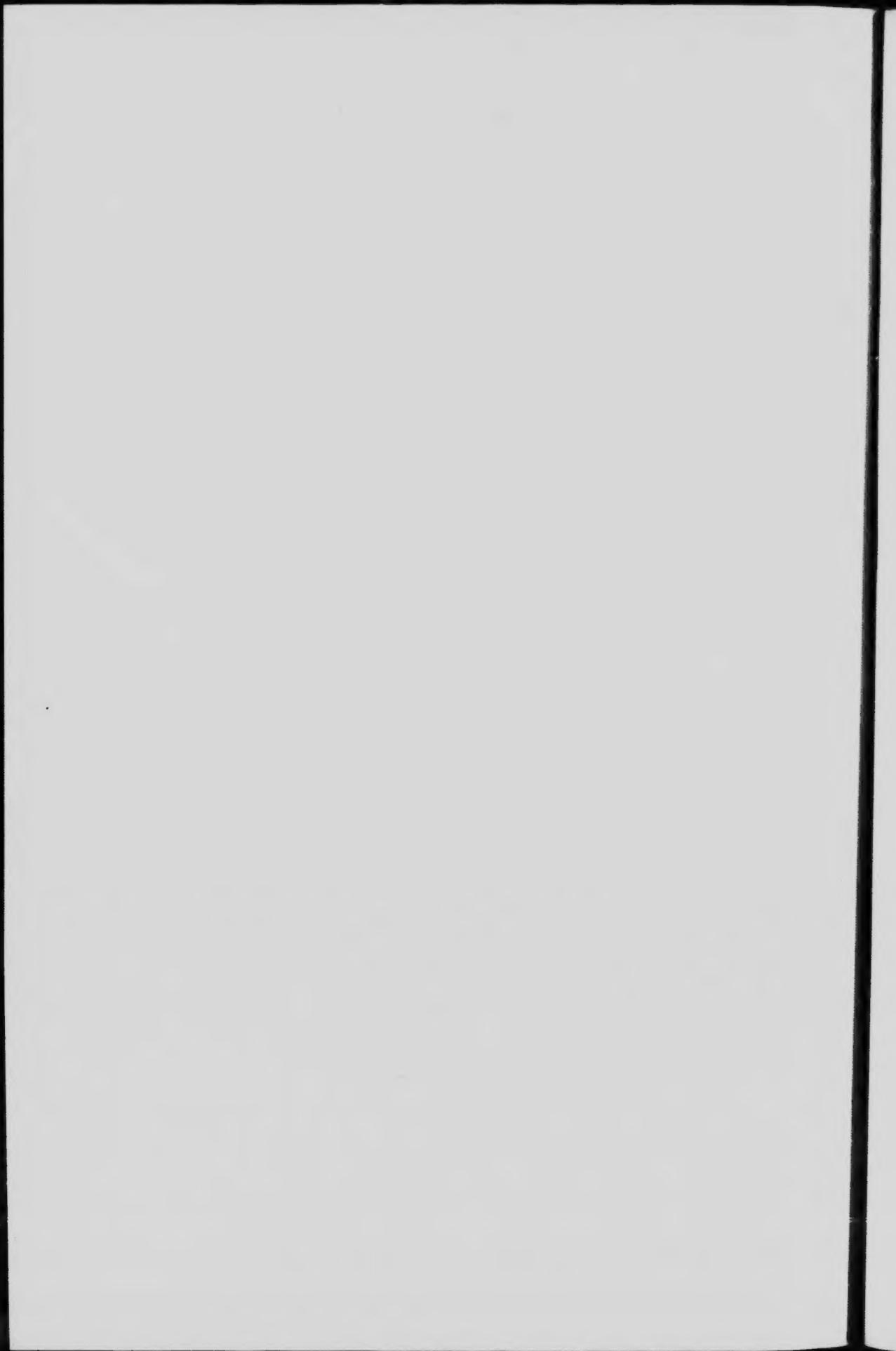
BY

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MINISTER OF AGRICULTURE



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HON. W. R. MOTHERWELL,
Minister of Agriculture.

SIR,—I have the honour to submit for your approval Bulletin No. 43 of this department, prepared by W. A. Wilson, Dairy Commissioner, dealing with the Variations in Cream Tests and the Difference between Butter and Butter Fat. I beg to recommend that the bulletin be printed for distribution.

I have the honour to be, Sir,

Your obedient servant,

F. H. AULD,
Acting Deputy Minister.

DEPARTMENT OF AGRICULTURE,
REGINA, *March 9, 1916.*

Variations in Cream Tests---Differences Between Butter and Butter Fat

INTRODUCTION.

Fortune awaits the inventor who places before the public a mechanical attachment for a hand cream separator that will regulate and maintain without variation the test of cream against all and sundry conditions arising in handling the milk before and during the process of separating. Excepting bad flavours in milk and cream it would eliminate the most objectionable yet wholly unavoidable circumstance obtaining in the business transactions between the farmer and the creamery, viz: "The variation of the cream test." Since the invention of the Babcock test and particularly since the introduction of the hand separator the question, "Why does my test vary?" has been asked and answered hundreds of times. The fact that it does vary has always been a greater annoyance to the creameryman than to the farmer because he is helpless to control it and is constantly under suspicion of depriving the farmers of their just returns.

GENERAL.

The creamery movement each year is becoming a more important factor in agricultural development. The general lack of information among beginners—and there are always beginners—makes the clerical work of the creameries throughout the province burdensome because of repeated inquiries concerning the test. The difference between "butter" and "butter fat" is also generally misunderstood.

The publication of this bulletin we hope will accomplish a three-fold purpose. First, give information concerning the variation of the cream test and the difference between butter and butter fat, second, save considerable time in correspondence on the part of the creamery management and third, assist to eliminate suspicion of wrong doing which necessarily retards interest in dairying and consequently the extension and development of the work.

There are no complicated features associated with the creamery work. Those desirous of ascertaining facts can readily do so, but every creamery has to do business with people of varied types and character. Among these are to be found people who for lack of information and probably without any desire, misrepresent facts. This condition together with misunderstandings arising out of inexperience can only be removed through the dissemination of knowledge in the form of facts or a general process of education.

VARIATIONS IN CREAM TESTS.

At a series of 13 short courses in the dairy instruction car operating over a territory of 90 miles the actual work of separating the same lot of milk under different conditions was conducted before the audience and samples of cream taken and tested in their presence. Table No. 1 gives the result of seven trials. In each case the same milk was thoroughly mixed, divided into three lots and separated at temperatures of 98, 80 and 70 degrees Fahr. All other conditions were kept uniform in each particular trial, but not necessarily so in the series, the object being to have the trials made under varied conditions as found on different farms.

TABLE NO. 1.

Trial No.	Milk Test Per Cent.	Temperature of Milk	Cream Test Per Cent.	Skim Milk Test Per Cent.
1	3.6	98	41	.01
	3.6	80	48	.015
	3.6	70	50	.02
2	3	98	32	.005
	3	80	37	.01
	3	70	41	.01
3	4.3	98	37	.01
	4.3	80	43	.02
	4.3	70	47	.025
4	3.6	98	31	.01
	3.6	80	34	.02
	3.6	70	41	.03
5	3.5	98	17	.01
	3.5	80	21	.015
	3.5	70	24	.03
6	3.8	98	25	.06
	3.8	80	31	.08
	3.8	70	32	.15
7	4	98	24	.06
	4	80	27	.05
	4	70	35	.1

The cream screw adjusted for trials 2, 3, 5, 6 and 7.

Here we have a variation of as much as 11% in the test from the same milk as a result of separating at a temperature of 98 and 70 degrees. Such a wide variation is not shown throughout but a very marked difference in the test occurs in every case. The percentage of fat in the milk affects the cream test and in addition the latent physical conditions which cannot be determined. The trials were conducted in the month of January and the milk was received from the farmers at various points from cows newly freshened, cows advanced in lactation and the milk more or less badly frozen.

SPEED OF SEPARATOR.

Table No. 2 shows the results of separating six different lots of milk with the bowl or crank operating at different speeds.

TABLE NO. 2.

Trial No.	Milk Test Per Cent.	Speed of Separator Handle	Cream Test Per Cent.
1	3.6	60 rev.	41
	3.6	50 "	22
	3.6	55 "	26
	3.6	62 "	44
2	3	60 "	32
	3	50 "	19
	3	55 "	22
	3	62 "	37
3	4.3	60 "	37
	4.3	50 "	24
	4.3	55 "	30
	4.3	62 "	54
4	3.6	60 "	31
	3.6	50 "	19
	3.6	55 "	22
	3.6	62 "	36
5	3.8	60 "	26
	3.8	50 "	16
	3.8	55 "	18
	3.8	62 "	27
6	4	60 "	24
	4	50 "	16
	4	55 "	18
	4	62 "	27

Cream screw adjusted slightly for trials 5 and 6.

The correct speed of the separator used for these trials is 60 revolutions of the handle per minute. The first trial shows the greatest difference, the test dropping from 41 to 22 per cent. by reducing the speed of the crank from 60 to 50 revolutions per minute, when it was increased to 55 turns the test went up to 26 and then to 44 per cent. when the speed went to 62 revolutions.

AMOUNT OF MILK MAINTAINED IN SUPPLY TANK OF SEPARATOR.

Table No. 3 gives the tests of cream from seven trials with the receiving tank of the separator full and almost empty. In each trial the test is from the same milk.

TABLE NO. 3.

Trial No.	Milk Test Per Cent.	Amount of Milk in Receiving Can	Cream Test Per Cent.
1	3.6	Can full	37
	3.6	Can almost empty	40
2	3	Can full	25
	3	Can almost empty	29
3	4.3	Can full	32
	4.3	Can almost empty	35
4	3.6	Can full	25
	3.6	Can almost empty	30
5	3.5	Can full	17
	3.5	Can almost empty	20
6	3.8	Can full	21
	3.8	Can almost empty	22
7	4	Can full	17
	4	Can almost empty	18

The greatest difference shown is 5 per cent. and down to one per cent. The volume of milk in the supply tank affects the pressure per square inch on the feed to the separator bowl and has a direct bearing on the rate of inflow. A reduction of the inflow makes a richer cream.

WHY THE CREAM TEST VARIES.

The effect of the cream screw on the test of cream is quite generally known and it is just as generally not known that other important factors affect the results. These are summarized as follows:

1. Adjustment of cream screw.
2. The temperature of the milk when separated.
3. The speed of the separator bowl, or the crank.
4. The rate at which the milk flows into the separator bowl.
5. The richness of the milk when separated.
6. Whether the milk is from newly freshened cows or from cows advanced in lactation.
7. The depth of milk maintained in the supply tank of the separator.
8. The vibration of the separator.
9. The amount of water or skim milk used to flush the bowl after separating.
10. Washing of the separator regularly.
11. Sudden changes in food and surroundings affecting the physical condition of the cows.

The most careful precautions with the object of keeping all of those conditions constant cannot prevent a difference in the cream test that will at times be unexplainable. Repeated tests and trials at experiment stations have demonstrated this fact. It can be attributed to weather and seasonable changes and to latent conditions and changes in the milk brought about by unknown and unusual changes in the individual cow and in the herd. These are quite beyond the control of the owner and the person operating the separator. It would, therefore, be a happy day for the creamery operator if some mechanical device were brought into practical operation that would make it impossible for the cream test to vary.

SUMMARY.

ADJUSTMENT OF CREAM SCREW.

Comment under this heading is unnecessary. It is known and admitted that any adjustment of the cream screw makes a difference in the cream test.

TEMPERATURE OF THE MILK.

Table 1 will reveal something new to many who are using hand separators. A variation of from 7 to 11 per cent. in the same milk separated at different temperatures is information not generally known. Reducing the temperature makes the milk more viscous. It does not run through the separator so rapidly and in consequence a richer cream is produced.

SPEED OF THE SEPARATOR BOWL OR THE CRANK.

Separation of the fat from the milk serum is made possible because it is the lighter substance. The centrifugal force generates pressure. The greater the speed of the bowl the greater the pressure. With the increased speed the amount of cream is condensed and made richer. Conversely a reduction in speed enlarges the volume of cream by allowing more skim milk to escape through the cream outlet and makes for a lower test.

RATE AT WHICH THE MILK FLOWS INTO THE SEPARATOR BOWL.

If the inflow of milk to the bowl is reduced and the regular pressure maintained by keeping up the speed the cream line will be narrowed and a richer cream given.

RICHNESS OF THE MILK SEPARATED.

Milk from the same herd given the same feed and care will vary in fat content from day to day. It will also vary as the period of lactation advances. The richer the milk, other conditions in separating remaining unchanged, the richer the cream will be.

MILK FROM COWS NEWLY FRESHENED OR ADVANCED IN LACTATION.

The milk from newly freshened cows will show a lower fat test than the milk from the same cows after a period of several months milking. Remarks under paragraph 5 will govern this case.

DEPTH OF MILK MAINTAINED IN THE SUPPLY TANK.

This affects the rate of inflow and comments under paragraph 4 will explain. With the supply tank full there is greater pressure on the outlet from the tank to the separator bowl and the flow of milk is more rapid than if the supply tank was half full or nearly empty.

VIBRATION OF THE SEPARATOR.

Any shaking of the machine disturbs the separating process and interferes with the cream line in the separator bowl, usually resulting in a surplus of skim milk escaping through the cream outlet and giving a thinner cream.

QUANTITY OF WATER OR SKIM MILK USED TO FLUSH THE BOWL AFTER SEPARATING.

The result of this practice is obvious as part of the flush water or skim milk goes into the cream and must reduce the test. The effect depends on the amount used.

WASHING THE SEPARATOR REGULARLY.

Uniform results cannot be expected unless the separator is washed after each operation. Anything less than regular and careful washing may result in clogging either the cream or skim milk outlet by the accumulation and drying on of solid matter.

SUDDEN CHANGES IN FOOD AND SURROUNDINGS AFFECTING THE PHYSICAL CONDITION OF THE COWS.

Exposure to severe weather and sudden and wide changes in food, also undue excitement of any kind affects the fat content of milk and this may be reflected in the cream test.

Eleven causes are given, each one of which affects in various degrees the cream test. A combination of these may show variations much wider and different from what any single one would show. Altogether the forces going to make the test vary are such that a uniform test from day to day and week to week is not always possible.

The lowering of the per cent. of fat in the cream is simply the result of allowing more skim milk to remain in it, thus reducing

the test but increasing the weight. When the cream test goes up the opposite condition applies.

Example.

Lbs. Whole Milk	Lbs. Skim Milk	Lbs. Cream	Test	Total Lbs. Butter Fat	Value at 30c per lb.
200	170	30	30	9.0	\$2.70
200	150	50	18	9.0	\$2.70

Failure to take into account or not knowing these ever present causes of variation in cream richness leads to much misunderstanding on the part of the farmer regarding the accuracy or honesty of cream tests. He cannot understand why his cream test varies when he is milking the same cows, fed and cared for in the same way and has not changed the adjustment of the separator.

Diagram representing test of cream as influenced by the temperature of the whole milk.

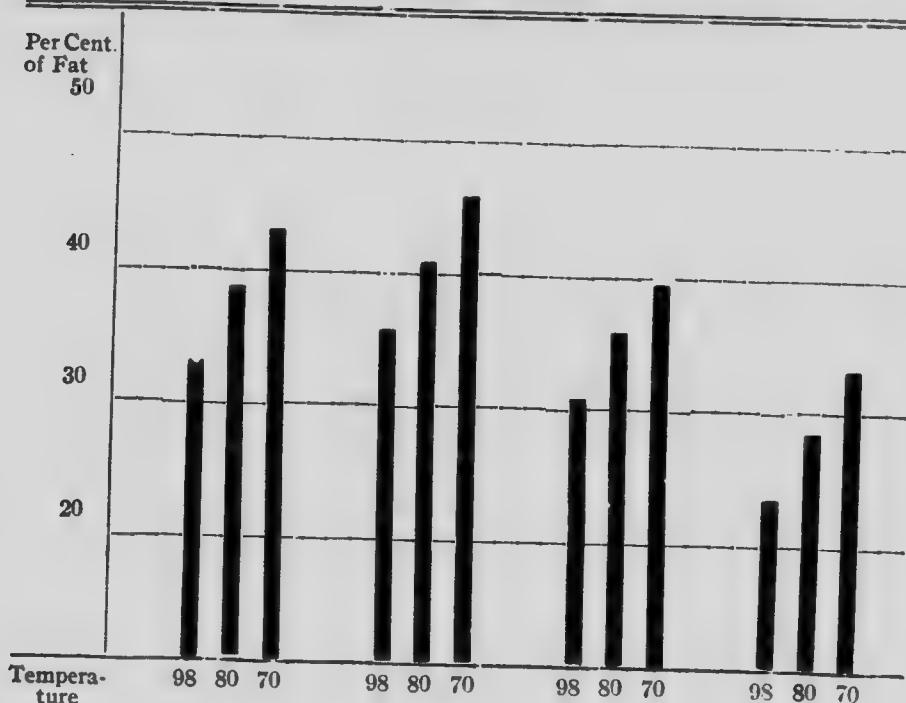
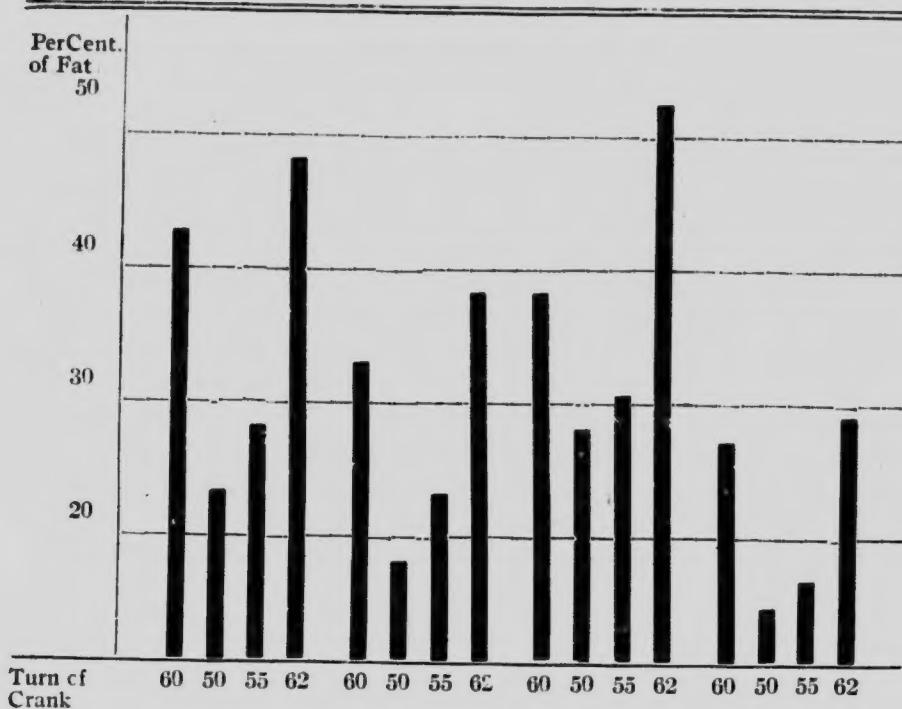


Diagram representing test of cream as influenced by revolutions of the crank per minute.



DIFFERENCE BETWEEN BUTTER AND BUTTER FAT.

Comparisons of the weight of butter churned at home and the butter fat credits at the creamery are not infrequent. These emanate from the belief that butter and butter fat are the same, also that a given quantity of cream should at all times contain the same quantity of butter fat. Allowance is not made for a variation in the cream test. Butter is the product of the cream churned and the average composition is as follows:

COMPOSITION OF BUTTER.

Butter fat.....	82
Water.....	15
Salt and foreign matter.....	3
Total.....	100

Butter fat, as its name indicates, is the pure fat or oil contained in the milk or cream. As shown in the composition of butter a hundred pounds of butter contains 18 pounds of water, salt and foreign matter. This quantity can be very greatly increased by methods adopted in the churning operations and the attention given the cream before churning.

On the dairy instruction car experiments were conducted in manufacturing butter to demonstrate to the audience how the weight can be increased when the quality of the butter churned is not considered as an important factor.

TABLE SHOWING THE DIFFERENCE IN WEIGHT OF BUTTER CHURNED FROM ONE LOT OF CREAM DIVIDED INTO TWO LOTS OF EQUAL WEIGHT AND CHURNED UNDER DIFFERENT CONDITIONS

Trial No.	Per Cent. of Fat in Cream	Weight of Cream		Churning Temperature		Time Churning		Weight of Butter		Weight of Buttermilk		Buttermilk Test Per Cent. of Fat	
				No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
		No. 1	No. 2					lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		
1	41	26 lbs.	26 lbs.	55	60	25 min.	15 min.	8	9	17	16	.15	.3
2	32	21 lbs.	21 lbs.	55	60	25 min.	10 min.	7	4	13	12	.15	.35
3	31	21 lbs.	21 lbs.	58	61	23 min.	12 min.	5	2	15	8	.14	.10
4	20	21 lbs.	21 lbs.	59	64	20 min.	10 min.	4	6	13	8	.06	.35
5	21	16 lbs.	16 lbs.	58	63	33 min.	10 min.	4	4	11	8	.18	.3
										10	10	.1	

The cream used for these trials was obtained from farmers along the line of railway and the proper churning temperature was not known in advance. In this respect the operators were working under regular farm conditions. Apart from the churning temperature all No. 1 churning were done after the correct method while all No. 2 churings were done to increase the weight regardless of the quality.

There is a splendid lesson in these trials as the statement is sometimes made that more butter can be made at home than at the creamery. If one's aim is to secure the maximum weight regardless of quality there would be little difficulty in satisfying the most critical, but serious trouble would arise when the price was made known, as the quality of the product would not command very much value in the open market. The creamery can serve the farmers best by having quality in the finished product as the main objective. It is the only way the dairy industry can be developed. Education will in time eliminate smaller troubles and influence the producer to give more attention to the important phases of dairying which are too often overlooked.